

# **The Reinterpretation of Claudius Ptolemy's Germania Magna – with the help of computer-aided image distortion of a medieval map representation of Donnus Nicolaus Germanus – and considerations on the postglacial geodynamics of Europe**

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**Abstract.** This paper explores a reinterpretation of Claudius Ptolemy's depiction of Germania Magna, proposing that extensive landscape transformations occurred due to postglacial land uplift and tectonic activities. The author suggests that Germania Magna, as described by Ptolemy, corresponds roughly to the modern Federal Republic of Germany, excluding parts of present-day Poland. The study delves into geological processes such as the reactivation of the Caledonian Deformation Front and tectonic forces causing land uplift. It discusses possible causes for the regression of the Oceanus Germanicus, including shifts in relative sea levels and volcanic activity. Additionally, the paper examines historical climate data to infer warmer temperatures during Ptolemy's time and the Middle Ages. The author hypothesizes migration patterns of seafaring tribes to the islands of Germania Magna and suggests connections to Viking settlements. Archaeological evidence, including ship finds, is reinterpreted in light of landscape changes. The study proposes a closer link between the Alpine orogeny and the uplift of Scandinavia, suggesting a complex interplay of geological forces shaping Northern Europe's landscape. Finally, it discusses the formation of geological features such as graben structures and their implications for understanding the region's geological history.

**Keywords:** Germania Magna, Claudius Ptolemy, Postglacial land uplift, Caledonian Deformation Front (CDF), Trans-European Suture Zone, Thor Suture zone, Viking settlements, Continental drift, Oceanus Germanicus, North Sea Central Graben, Central European depression, Scandinavia, Alpine orogeny, Avalonia, Baltica, Vistula Fluvius, Albis Fluvii, Black Elster, Schwarze Elster, Spree, Oder, Avalonia, Baltica, Budorigum, Stragona, Nomisterium, Gotones, Goths, Scandzia, Scandia, Oderbruch, Ziltendorfer Niederung, Brandenburg, Mecklenburg-Vorpommern, Schleswig-Holstein, Niedersachsen, Europe

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## 1 Introduction

In his draft on “The Reinterpretation of Claudius Ptolemy’s Germania Magna – with the help of computer-aided image distortion of a medieval map representation of Donnus Nicolaus Germanus – and considerations on the postglacial geodynamics of Europe”, the author describes his assumption that Germania Magna was subject to a more comprehensive landscape transformation than previously assumed, due to the postglacial land uplift in the late Holocene, or due to a possible reactivation of the Caledonian Deformation Front (CDF) in the course of a late activity phase of the Alpine orogeny and the associated tectonic activities in the upper earth crust.\*). These are possibly connected with hitherto unassigned or incorrectly dated fracture events of larger scale, which could also have led to stronger earthquakes in Europe and which may even have been handed down to us from the Middle Ages[1]. According to the interpretation, the area of Germania Magna described by Ptolemy corresponds in its latitudinal extent approximately to the area of the Federal Republic of Germany, i.e. without including parts of present-day Poland, as previously described by other interpretations. Large parts of the Central European Depression, however, were probably covered by a shelf sea – at least temporarily. Denmark, or Jutland, had no connection to the mainland, according to the representation of Germania Magna and according to this interpretation.

Which geological processes led to a possible regression of the Oceanus Germanicus is not the primary subject of this interpretation, but the author suspects several factors here, which have already been outlined in the publication and which could form a common cause for this. According to the latest considerations, however, the reactivation of the CDF in the course of a late activity phase of the Alpine orogeny (i.e. in more recent times) seems to be a possible main cause. During this event, tectonic forces caused Avalonia to be thrust eastward onto the Baltic continental plate, possibly depressing it (potentially a beginning subduction, but temporally limited and regionally restricted to the eastern part of the Avalonian continental plate) - with the consequence that the relative sea level (RSL) at the North German coast fell and that land areas in the Oceanus Germanicus suddenly lay below sea level. Both Vesuvius and Etna in Italy, as well as the volcanoes on Iceland, had several strong eruptions in the mentioned periods (e.g. 79 AD the eruption of Vesuvius, which destroyed Pompeii), which suggests a general high level of geoactivity in Europe that could have led to stresses in the lithosphere and triggered or intensified continental drift. In this context, maybe the (renewed) uplift of the island of Rügen, which represents the rest of the tip of the Avalonian plate eroded away and protrudes from the sea, could also have taken place.

The publication initially assumed post-glacial land uplift to be the main cause of a regression, which, in conjunction with the end of a warm period (the Roman climatic optimum), could consequently have led to a falling relative sea level (RSL) on the North German coast. Previously, even less water may have been bound in glacial ice than after the Little Ice Age in the Late Middle Ages – i.e. in the last five hundred years up to almost the present day. The work of Olav Liestøl was used in this consideration, who in the late 1950s evaluated the course of the firm line of western Norwe-

gian glaciers over a period of about 10,000 years (Glaciers of the present day. In: Olaf Holtedahl Geology of Norway. (=Norges Geologiske Undersökelse, Nr. 208). Oslo, 1960.).

Also according to W. Dansgaard et al. (1969), Schönwiese (1995) and Roth (2018), and not least the word etymology of Greenland as “Greenland”[2], already indicate that the average temperature at the time of Ptolemy and during the Middle Ages was higher over longer periods than in the last five hundred years, and that Greenland was initially perceived as green and thus as fertile when it was named. Erik the Red is considered one of the first Vikings to settle Greenland at that time. His life is reported in Nordic sagas, here especially in the *Eiriks saga rauða*.

So it is likely that sea peoples, as ancestors and relatives of the Vikings, developed on the island groups in the northern Germania Magna (cf. also Varangians), or the Vikings themselves. It is probable that these seafaring tribes migrated from the mainland to the islands in the Oceanus Germanicus, not least due to the expansion pressure in the Roman Empire – or, since they lost their original settlement areas due to the transgression. For the same reason, the *Völkerwanderung* could also have started, if not warlike conflicts were the main motive here.

It can be assumed that at that time many fortifications and early water castles, or even entire cities (cf. The Saga of Vineta) were built in the shallow water, on islands and on peninsulas (cf. also the article on Viking ring fortresses or generally on ramparts), or that the inhabitants lived on protected marshland islands (Halligen), or that these buildings were later silted up or destroyed by flooding events. Taking into account the present interpretation, the author also finds it quite conceivable that historically recorded storm floods in the North Sea and Baltic Sea can in fact be attributed to earthquake-induced tsunamis (cf. Mandränke).

However, the present interpretation may also provide a better explanation for archaeological ship finds[3] in Mecklenburg-Western Pomerania, which can initially be interpreted as grave goods, but which could then also have been sunken ships that were covered by sand and silt as a result of the silting-up process.

## **2 possible uplift of the Avalonian continental plate by the mountain building process and the reactivation of the Caledonian Deformation Zone (CDF) (or the formation of a high mountain range in the Oceanus Germanicus)**

A further folding or tilting of the continental crust, or the land surface, could also be a major cause for the possible uplift of the North German coastal area and the Central European Depression, caused by a north-south directed thrust force, which in the context of the Alpine orogeny could also have led to a further uplift of the Erzgebirge in recent geological times, or perhaps even to an uplift of the low mountain ranges along the Thuringian-Franconian-Vogtland Slate Mountains, further along the Main river to the Rhenish Slate Mountains, with the Taunus and Hunsrück. In addition to a

northward tilt, a westward tilt of the Avalonian continental plate could also have been caused, since an overthrust onto Baltica could not have occurred equally at all sutures, or since Avalonia is overlain by Laurentia to the west.

Please also refer to the work of Lyngsie, S.B. & Thybo, H. (2007). A new tectonic model for the Laurentia–Avalonia–Baltica sutures in the North Sea: A case study along MONA LISA profile 3. *Tectonophysics*. 429. 201-227. 10.1016/j.tecto.2006.09.017., which shows that the continental crust of Baltica had already begun to fold in the study area (Caledonian foreland thrust belt), presumably as a prelude to the formation of an accretionary wedge in the Jutland area, with the possible further consequence of a northward displacement of the Sorgenfrei-Tornquist Zone due to the forces acting here.

A comparable event has taken place in the past, for example, to a greater extent in the collision of India with Eurasia [7] (cf. Jiang, Feng & Chen, Xiaobin & Unsworth, Martyn & Cai, Juntao & Han, Bing & Wang, Lifeng & Dong, Zeyi & Tengfa, Cui & Zhan, Yan & Zhao, Guoze & Tang, Ji. (2022). Mechanism for the Uplift of Gongga Shan in the Southeastern Tibetan Plateau Constrained by 3D Magnetotelluric Data. *Geophysical Research Letters*. 49. 10.1029/2021GL097394.). Ultimately, this would be the process of mountain formation in its initial stage, which was possibly interrupted at the North German coast, since three continental plates are wedged together here (Avalonia, Baltica and Laurentia), which is why stronger forces would be necessary to continue the process at this point, but which can already be traced back over the representation of the Germania Magna. Thus, the process of the Alpine orogeny has possibly shifted from the Alps more towards Scandinavia in our time, or perhaps significant uplift is currently only taking place there (cf. last paragraph). Depending on the activity of the Mid-Atlantic Ridge and the force that the collision with the African continental plate exerts on Europe, this could be another conclusion.

However, it could also be understood that there could rather be phases of stronger and phases of weaker activity, rather than it being a uniformly occurring process of mountain building and that there must also have been very strong phases of activity in the meantime in order to bring about the landscape change (the change in geomorphology) to the necessary extent (since this process has so far hardly been recorded as such, especially in Northern Europe, and has probably been in a rather inconspicuous activity stage here since the beginning of modern geosciences).

It is also worth mentioning that the shortening of the continental crust in length obviously also goes hand in hand with its uplift, which leads to graben fractures in the hinterland. [7] (cf. again Jiang, Feng & Chen, Xiaobin & Unsworth, Martyn & Cai, Juntao & Han, Bing & Wang, Lifeng & Dong, Zeyi & Tengfa, Cui & Zhan, Yan & Zhao, Guoze & Tang, Ji. (2022). Mechanism for the Uplift of Gongga Shan in the Southeastern Tibetan Plateau Constrained by 3D Magnetotelluric Data. *Geophysical Research Letters*. 49. 10.1029/2021GL097394.)

Thus, the Eger Graben may also have been more closely related to this process, or have been caused by earlier (perhaps even periodically occurring) events of the same nature. Likewise, however, it should also be considered whether the Elbe Valley Basin between Meißen and Dresden could ultimately be a result of such processes. In my opinion, the Germania Magna indicates that the area around the Elbe Sandstone

Mountains and the Lusatian Mountains could have experienced geomorphological changes in the meantime. According to the description of the Germania Magna, the Erzgebirge was already present, but it is difficult to say whether it may not have experienced another uplift in recent geological times, which is related to the tectonic-induced regression of the Oceanus Germanicus, or a (further) subsidence of the Erzgebirge foreland, as a result of a beginning overthrust of the continental crust at the coast – and, as already indicated, with the associated shortening of the continental crust in the interior of the country – although, according to the previous view, such processes should essentially have taken place at a much earlier point in time. However, even after the relief of the crust by the decrease of the force effect (relaxation), graben structures could probably still form.

It is therefore quite conceivable that there is an even closer connection between the current uplift of Scandinavia and the Alpine orogeny than previously suspected and that the postglacial land uplift could therefore only be partly responsible for this. The comparatively rapid uplift of Scandinavia in modern times could then possibly be attributed to a folding of the continental crust.

The approach of Scandinavia to Central Europe has probably also led to the formation of the North Sea Central Graben, as a bulge of the continental crust [11] (cf. Arfai, J., Franke, D., Lutz, R. et al. Rapid Quaternary subsidence in the northwestern German North Sea. *Sci Rep* 8, 11524 (2018). <https://doi.org/10.1038/s41598-018-29638-6>). Former land areas in the North Sea, such as Albionis pars, were probably thereby made part of this graben structure and have consequently fallen below the present sea level. In this context, there is perhaps also a closer relationship to the opening of the Upper Rhine Graben (cf. Mediterranean-Mjösen Zone). The area around the Rhenish Slate Mountains to the English Channel could have acted here as a pivot or anchor point (or as a support point) for a slight rotation, in which a change in the direction of the force took place, due to the solid structure in the subsurface, which only yielded to a limited extent.

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2. Preiser-Kapeller, J. (2020). The Long Summer and the Little Ice Age: Climate, Pandemics, and the Transformation of the Old World, 500-1500 AD, ISBN 978-3854768890, also taking into account the etymology of Greenland as “Grünland” [Greenland].
3. For example, so-called “Usedom Boat Graves” see BIERMANN, Felix. Usedomer Bootsgräber. Germania: Anzeiger der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts, 2004, 82nd edition, No. 1, pp. 159-176.
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Mildner, Sven. (2020). The reinterpretation of Claudius Ptolemy’s Germania Magna – with the aid of computer-assisted image distortion of a medieval map by Donnus Nicolaus Germanus – and considerations on the postglacial geodynamics of Europe. 10.23689/fidgeo-5907.

## Figures

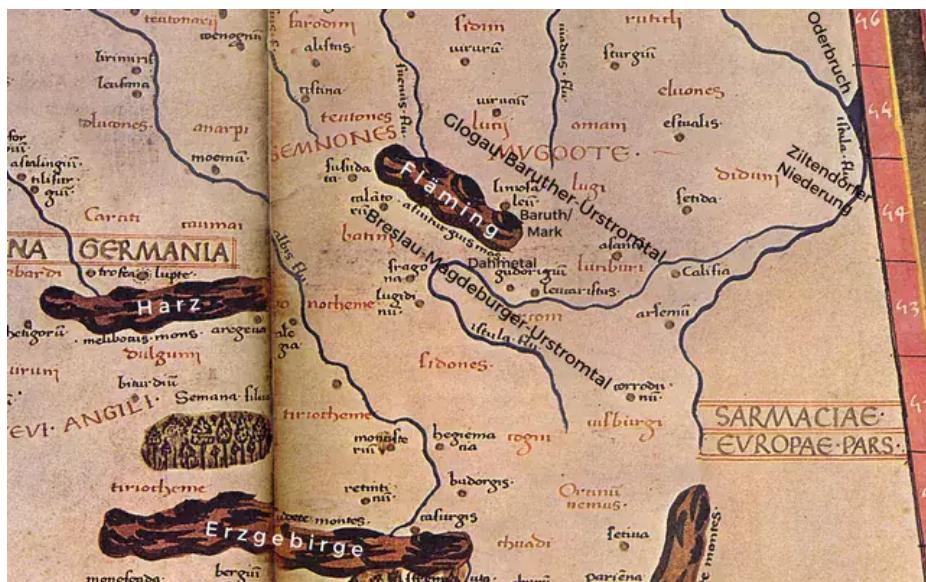


Figure 1: The location of the Vistula Fluvius on the Germania Magna map, with the Oderbruch and Ziltendorfer Niederung situated in the far east of the map. A transform fault may run here, which could have been caused by a partial thrusting of Avalonia onto the Baltic continental plate (cf. Jiang, Feng & Chen, Xiaobin & Unsworth, Martyn & Cai, Juntao & Han, Bing & Wang, Lifeng & Dong, Zeyi & Tengfa, Cui & Zhan, Yan & Zhao, Guoze & Tang, Ji. (2022). Mechanism for the Uplift of Gongga Shan in the Southeastern Tibetan Plateau Constrained by 3D Magnetotelluric Data. Geophysical Research Letters. 49. 10.1029/2021GL097394.). Oderbruch and Ziltendorfer Niederung could therefore have originated from an earlier valley depression, which was pulled apart or offset along a transform fault.



Figure 2: The Vistula Fluvius could partly correspond to the current path of the Schwarze Elster (Black Elster) and the Kleine Elster, running just a few kilometers further south than initially described in the variant through the Dahme valley. However, it is also possible that these are simply different temporal variations of the Vistula Fluvius, with corresponding oxbow formation and subsequent sedimentation. On its way from the source to the mouth, the Kleine Elster river only overcomes a height difference of 30 m (over a length of 58.8 km). Further geological investigations could contribute to further clarification in the future. The place Stragona could probably be assumed to be near the present-day city of Herzberg (in the Elbe-Elster district), and Budorigum near Doberlug-Kirchhain. It is still questionable whether the Elbe (albis fluvii) can indeed be located in its current course or whether the map might even depict the course of the Freiberger Mulde or the united Mulde. In that case, the place Nomisterium might be found near Nossen (in high-medieval documents: “Nozin”), otherwise Meißen (Upper Sorbian: Mišno, Czech: Míšeň, Latin: Misnia or Misena) would be considered here.

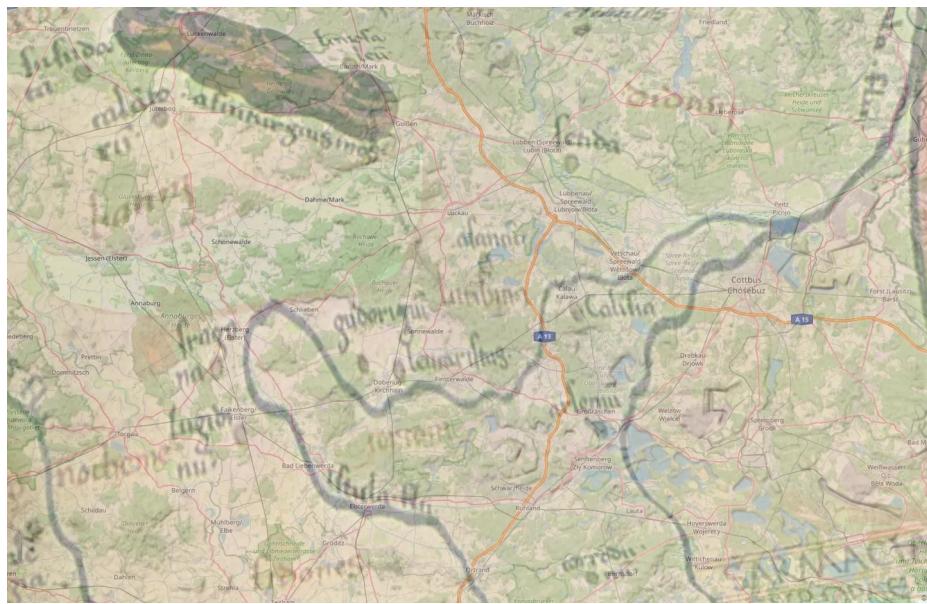


Figure 3: A stronger distortion of the Germania Magna representation is necessary here to adequately match the recorded locations. However, the result of such a map overlay appears to be very plausible. For example, at the confluence of the Schwarze Elster and Spree rivers, which the author initially identifies as the depicted rivers, a medieval fortress (Peitz Fortress) was built in the present-day town of Peitz. It is known that this fortress was surrounded by an old arm of the Spree.

For more information, please visit the following website of the Historical Society of Peitz e.V.: <https://festungpeitz.de/>

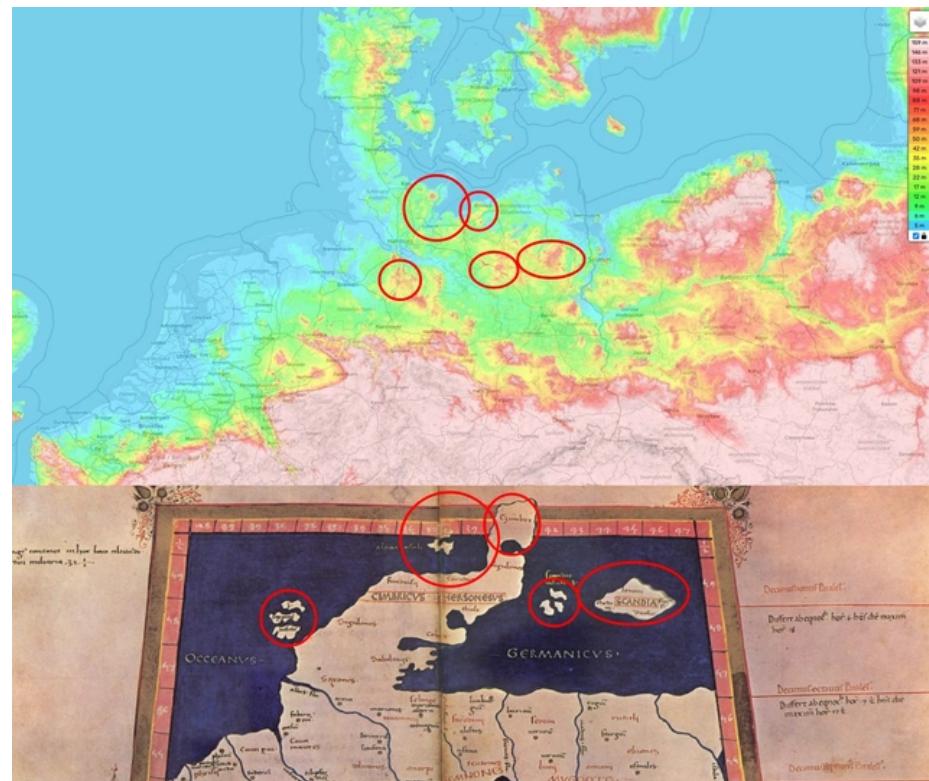


Figure 4: A comparative presentation between the medieval Germania Magna map by Donnus Nicolaus Germanus and a colored depiction of current elevation data (DGM).

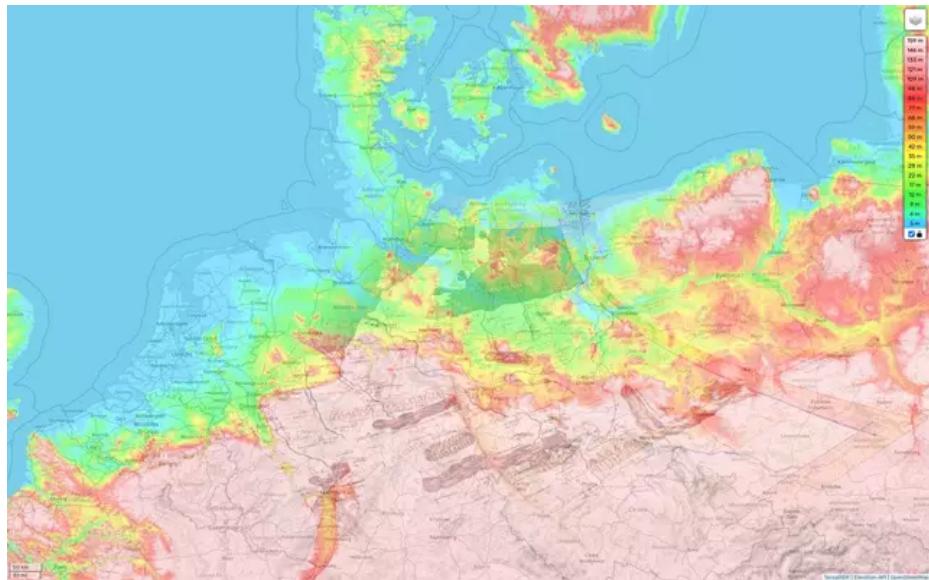


Figure 5: This image depicts a colored representation of current elevation data (DGM), overlaid with the Germania Magna map by Donnus Nicolaus Gemanus

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